REPORT

Predictors of Preterm and Small-for-Gestational-Age Births in Alberta

2007

Alberta

Suggested citation: Twilley, L. & Wang, F-L. (2007). *Predictors of Preterm and Small-for-Gestational-Age Births in Alberta.* Edmonton, AB: Alberta Health and Wellness.

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ISBN 978-0-7785-6073-9 Report
ISBN 978-0-7785-6074-6 PDF

2008-03606/

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1 EXECUTIVE SUMMARY

Records of live singleton births occurring in the province of Alberta between 1997 and 2004 were analyzed. Births were categorized according to outcomes—small-for-gestational-age preterm births, small-for-gestational-age term births, and preterm but not-small-for-gestational-age births.

Associations between a number of maternal and infant indicators and these outcomes were considered. The goal was to understand the differing influences of the maternal and infant indicators on the three birth outcome groups, with a particular emphasis on potentially modifiable factors.

Small-for-Gestational-Age Preterm Births

Preterm small-for-gestational-age births were most strongly associated with congenital anomaly, previous infant deaths and stillbirths, induced labour and cesarean section.

There were smaller effects of potentially modifiable factors for small-for-gestational-age preterm births. Maternal prenatal smoking, as well as maternal age of 35 and older, were associated with increased risk of small-for-gestational-age in preterm births. Women who attended prenatal classes had a reduced risk of small-for-gestational-age preterm births.

Small-for-Gestational-Age Term Births

Small-for-gestational-age term births showed strong associations with potentially modifiable factors.

Maternal prenatal smoking was the factor most strongly associated with small-for-gestational-age births at term, and there were additional independent effects of giving birth at age 35 or older, especially for mothers who smoked or first-time mothers. Prenatal class attendance and having three or more prenatal visits with a physician or midwife were associated with reduced risk of small-for-gestational-age in term births.

1 EXECUTIVE SUMMARY (continued)

Preterm Not-Small-for-Gestational-Age Births

Preterm not-small-for-gestational-age births had large associations with previous infant deaths and congenital anomalies in the current birth, similar to small-for-gestational-age preterm births.

Maternal prenatal smoking and maternal age of 35 or older were also associated with increased risk of preterm not-small-for-gestational-age births. Regular prenatal visits and attendance and prenatal classes were strongly associated with reduced risk of these births.

Summary

Reducing the rate of maternal prenatal smoking and delayed childbearing, in concert with promoting regular prenatal visits and prenatal education, are the most likely routes to reducing adverse birth outcomes, especially small-for-gestational-age, and to a lesser extent, preterm births.

There are roles for both individual and institutional involvement in reducing adverse birth outcomes. Counseling about the risks of prenatal smoking and provision of smoking cessation programs would have beneficial effects. Prenatal care services would ideally be accessible, available, and affordable to all women, including women least likely to be engaged in care (those with language barriers, low incomes, low literacy and mental health challenges)[1,2]. Delayed childbearing rates might be lower if career support was available for women leaving the workforce temporarily for childbearing.

2 INTRODUCTION

2.1 Background

Ideally, a pregnancy involves achieving optimal growth in utero, followed by birth at term. However, in many cases, prenatal growth is restricted, or birth occurs before term. The births of early or small babies are a major public health concern, because preterm birth and low birth weight (whether preterm or small-for-gestational-age) are the primary causes of infant morbidity and mortality. Infants born too small or too early potentially face huge emotional, social, health, and financial burdens.

The preterm birth rate in Alberta is high and increasing. In 2005, one out of every 11 live births in Alberta was preterm. Alberta's small-for-gestational-age rate is also high (8% in 2005); small-for-gestational-age status is used here as a proxy for intrauterine growth restriction.[4]

Both low birth weight and preterm birth rates are higher in Alberta than the national average (as of 2004). Burdens on the Alberta health care system and on infants and their families are therefore expected to be higher than the national average.[4]

Preterm birth and intrauterine growth restriction can both result in low birth weight (<2,500 grams), and much of the available literature on perinatal health determinants and outcomes has focused exclusively on low birth weight, without differentiation between the subtypes of low birth weight. Low birth weight infants might be growth restricted, preterm, or both. (In some cases, infants may be low birth weight simply because they are genetically destined to be small, rather than because of intrauterine growth restriction or preterm birth. Conversely, some infants may in fact have been growth restricted at birth but because of genetic tendencies to be large, their weight does not make them small-for-gestational-age (SGA). There is currently no reliable methodology for identifying these infants).

Three distinct subsets of infants born with non-optimal gestations were identified: preterm babies who were small-for-gestational age, term babies who were small-for-gestational age, and preterm babies who were not-small-for-gestational-age.

By studying predictors of these subsets of infants separately, the goal was to further understanding of the risk and protective factors and consequently possible interventions for the often-confounded effects of prematurity and intrauterine growth restriction. The emphasis was on potentially modifiable factors, in the interest of promoting prevention efforts.

Vital Statistics Birth Registration Files

Live birth and stillbirth statistics were derived from Vital Statistics Birth Registration Files, managed by the Ministry of Service Alberta.

Registration of births via the Notice of Live Birth or Stillbirth form in Alberta is legally required, and the Birth Registration files are believed to be virtually complete. The Notice of Live Birth or Stillbirth form provides information about the infant, the birth, the infant's parents, maternal risk factors, and other demographic and health-related information.

All live singleton births to Alberta residents registered by Alberta Vital Statistics between January 1, 1997 and December 31, 2004 were included in the study. This amounted to 295,086 live births. Births to non-Alberta residents occurring in Alberta were excluded, as were stillbirths and multiple births (twins, triplets, etc.).

Alberta Congenital Anomalies Surveillance System

Data on congenital anomalies were obtained from the Alberta Congenital Anomalies Surveillance System (ACASS). ACASS collects data for all infants who are diagnosed with a congenital anomaly prior to their first birthday. ACASS data were linked with the Vital Statistics Birth Registration files with the birth registration identifier, with over 99% successful linkage.

2.2 Methodology

2.2.1 Data Sources

2.2 Methodology

2.2.2 Data Analysis Methods

Logistic regression analysis was used to model three distinct groups of birth outcomes: small-for-gestational-age term births, small-for-gestational-age preterm births, and preterm not-small-for-gestational-age births. Predictors included indicators available from the Birth Registration database (see Section 2.2.3).

The primary analysis outcome was odds ratios (OR). Odds ratios are the ratio of the odds of the occurrence of something in one group, to the odds of the same occurrence in another group. For example, the odds of small-for-gestational age births in mothers who smoke might be twice as high as the odds of small-for-gestational-age births in mothers who do not smoke, for an odds ratio of 2.0. When the odds in the two groups are equal, the odds ratio is 1.0, meaning the risk (e.g., of SGA) is not greater in the "at risk" group (e.g., smokers) than in the reference group (e.g., non-smokers). Odds ratios greater than one indicate a higher risk than the reference group, while odds ratios less than one indicate a lower risk than the reference group. The natural log of odds ratios (logOR) is often taken to create symmetry of odds ratios above and below zero. For log odds ratios, values greater than 0 indicate higher risk, while values below 0 indicate reduced risk compared to the reference group.

All variables were simultaneously entered into each model. The adjusted odds ratio for a given indicator can be interpreted as the contribution of that variable to the birth outcome of interest, after the contributions of all of the other variables are accounted for. In other words, the adjusted odds ratios reflect the independent contributions of the indicators.

The odds ratio for a given indicator is expressed as percentage increase in the birth outcome. For example, the odds ratio for maternal prenatal smoking in SGA preterm births was 1.38. This means that odds of SGA among preterm births was 38% higher in women who smoked during pregnancy than in women who did not smoke during pregnancy, after controlling for the effects of all other variables in the model.

Confidence intervals were used to assess the significance of odds ratios. Statistical estimates (such as means) are uncertain; the reported result of a statistical analysis is only the most likely result. A confidence interval tells us, with 95% certainty, the range within which the true value lies. For example, if an odds ratio estimate is 2.0, with a 95% confidence interval of 1.5 to 2.5, it can be said with 95% confidence that the true odds ratio is between 1.5 and 2.5.

2.2 Methodology

2.2.2 Data Analysis Methods (continued)

In order to keep as much data as possible in the models (to maintain statistical power), records with missing data were included as an additional category for each variable (although missing data categories do not appear in the tables). Bivariate comparisons of the missing groups to the reference groups indicated that missing values were more similar to risk groups than to reference categories. This makes the estimates of odds ratios conservative. If missing values were excluded, the odds ratios for risk groups would be more extreme (but with larger confidence intervals due to the decreased power of the analyses).

Interaction terms that were not significant were excluded from the models.

Figures show the log odds ratio for each of the indicators in a given analyses. Bars for odds ratios are colour- coded as follows: red for risk factors (log odds ratio of the birth outcome greater than 0 and confidence interval does not include 0), green for protective factors (log odds ratio of the birth outcome less than 0 and confidence interval does not contain 0), and grey for non-significant log odds ratios (confidence interval contains 0). The red and green bars are muted for non-modifiable factors, allowing the modifiable factors to stand out in the figures. Confidence intervals are plotted in light grey on the bars.

Tables include both adjusted odds ratios and log odds ratios.

2.2 Methodology

2.2.3 Indicators

Term
Gestational age at birth: Preterm (<37 weeks), Term (37 – 42 weeks), Post-Term (>42 weeks).

Small-for-gestational-age (SGA)
Birth weight of less than the 10th percentile on neonatal gestational age birth weight norms[3]: yes or no. In this report, infants who are small-for-gestational-age are assumed to be subject to intrauterine growth restriction (IUGR). That is, SGA is used as a proxy for IUGR.

Sex
Sex of the infant: male or female.

Rural residence
Maternal postal code beginning with T0 denotes rural residence: yes or no. This variable is most likely a proxy for socioeconomic status (lower in rural areas in general) and/or First Nations status (higher in rural areas in general), although the true nature of this variable is not well understood. Caution in interpretation is advised.

Congenital anomaly
The births database was linked to the congenital anomalies database to determine whether an infant was diagnosed with a congenital anomaly at birth or within the first year of life: yes or no.

Maternal age
Age group of the mother in years at time of birth: <20, 20-34, or >34 years.

Parity
Total births (live + still) to the mother, including current birth: 1, 2, or >2.

Marital status
Whether the parents were married to each other at the time of birth: married to each other or not married to each other. This variable may have its effects in part due to socioeconomic status: parents who are married to each other are likely to have greater access to economic resources than parents not married to each other. Caution in interpretation is advised.

Previous abortions
Total previous aborted pregnancies, including spontaneous and induced abortions; 0 or 1+.

Previous stillbirths
Number of previous stillbirths for the mother: 0 or 1+.

Previous infant deaths
Number of previous infant deaths for the mother: 0 or 1+.

Onset of labour
Whether labour was spontaneous or induced.

Cesarean section
Whether delivery was by cesarean section or not.
Number of prenatal visits
Total number of visits with physicians or midwives during the pregnancy; <3 or 3+. Note that mothers giving birth preterm have less opportunity to attend prenatal visits, so this variable is confounded with gestational age.
Prenatal class attendance
Attendance at prenatal classes (of any kind) or not. As with number of prenatal visits, this number is expected to be confounded with gestational age due to opportunity to attend. Furthermore, prenatal class attendance is far more common with first births than with subsequent births, and is thus correlated with parity.
Maternal prenatal smoking
Cigarette smoking behaviour of mother during pregnancy: yes (including quitting during pregnancy) or no.
Maternal prenatal alcohol consumption
Alcohol consumption by mother at any point in pregnancy: yes or no.
Maternal prenatal street drug use
Use of street drugs at any point in pregnancy: yes or no.

2.2 Methodology

2.2.3 Indicators
(continued)

2.2 Methodology

2.2.4 Data Limitations

Data appearing in this report are subject to a number of limitations, and all readers are encouraged to consider this section carefully.

Restricted data set
The Birth Registrations database is limited to the variables that appear on the Notice of Live Birth and Stillbirth. A number of factors known to affect birth outcomes (e.g., maternal prenatal conditions, complications of pregnancy, previous obstetrical history, socioeconomic status, etc.) are not included in the current report.

Self-reported data
The data on the Notice of Live Birth or Stillbirth is collected via self-report from the mother, shortly after birth. As such, the data are subject to recall and social desirability biases. In particular, socially undesirable maternal behaviours such as prenatal substance use are expected to be underreported. History of induced abortion is also expected to be underreported. Number of prenatal visits is likely to be estimated by many mothers, who may not recall exact number of visits; direction of bias in such recall is unknown.

Missing data
As outlined in the data analysis section, missing values were included as an additional category for each indicator in order to maintain the power of the model. The results would be different if missing values had been excluded: odds ratios would be more extreme, but confidence intervals would be larger (due to reduced number of cases).

Previously published data
Data in this report may differ from that previously published due to differences in methodology and/or dates of data extraction.

3 PREVIOUS FINDINGS

3.1 Preterm Births

Preterm birth has been called "one of the most intractable problems that contributes to perinatal morbidity and mortality in obstetric practice in developed countries" [5]. Both maternal and fetal factors are implicated, often in interactive fashion, and there are many unexplained factors. Improvements in prediction and in particular prevention of preterm birth have been slight.

A conservative estimate from 1995 states that a 20% reduction in Canada's preterm birth rate could save $2 billion in health care costs each year. [6]

About 70% of neonatal death and 75% of neonatal morbidity is associated with preterm birth. The risks associated with preterm birth are most severe when birth occurs prior to 32 weeks gestation. Preterm birth is responsible for large intensive care costs [7].

The most common short term effect of preterm birth is respiratory distress syndrome. Long-term morbidities are most often neurosensory (e.g., cerebral palsy, visual system disorders, hearing disorders), neurocognitive (e.g., lower IQ, lower academic achievement), or respiratory [5,9,10]. Higher survival rates for preterm babies in recent years have been accompanied by increased severe morbidity rates in survivors.[7]

An extensive review of the literature found causal effects on preterm birth rates of prior history of prematurity, prior spontaneous abortion, poor socioeconomic conditions, pre-pregnancy weight, very young maternal age, low maternal education, in utero exposure to diethylstilbestrol, maternal prenatal smoking. Other potentially important factors were stress, maternal work, general morbidity, genital tract infection, environmental toxins, and quality of antenatal care. Recommended public health interventions for preterm birth included anti-smoking efforts, selective caloric supplementation before pregnancy, delayed childbearing in young adolescents, improved maternal education, and selective improvements in socioeconomic conditions.[8]

Associations have also been reported between preterm birth and multiple pregnancy, hypertensive disorders of pregnancy, intrauterine growth restriction, antepartum hemorrhage, cervical incompetence, uterine malformation, assisted reproduction, and ethnic origin. [5]

3.2 Small-for-Gestational-Age Births

Babies born with low birth weight tend to use more hospital resources. In 2002–2003, the average hospital costs per newborn ranged from $795 for normal birth weight babies born via vaginal delivery to $117,806 for newborns weighing less than 750 grams. About one out of every seven newborns in Canada spent time in a neonatal intensive care unit in 2003-04. [12] Annually, about $13 billion is spent on the care of low birth weight infants in Canada.[13]

Infants with inadequate birth weights face increased risk of neonatal morbidity and mortality, restricted growth, impaired neurological and cognitive development, and chronic diseases such as asthma, diabetes, hypertension, and cardiovascular disease. [8,14,15] The most severe outcomes generally occur in the infants with the lowest birth weights.

Small-for-gestational-age status is the commonly used proxy for intrauterine growth retardation (IUGR). Fetal, maternal, and environmental factors all potentially contribute to IUGR.

In an extensive review of the literature, maternal prenatal smoking was the most important factor in IUGR in developed countries, followed by poor gestational nutrition (low weight gain or caloric intake) and low pre-pregnancy weight. Other factors associated with IUGR included female sex, non-Caucasian ethnic origin, low maternal birth weight, primiparity (first birth), prior history of low birth weight, short maternal height, poor socioeconomic conditions, general morbidity, very young maternal age, and low maternal education. Recommended public health interventions included anti-smoking efforts, selective caloric supplementation before pregnancy, delayed childbearing in young adolescents, improved maternal education, and selective improvements in socioeconomic conditions. Other potentially important factors were maternal haemodynamics, narcotic addiction, environmental toxins and noise, and quality of antenatal care [8].

Multiple gestation (twin or higher order pregnancy) and advanced maternal age have also been implicated in small-for-gestational-age births. [13]

3.3 Similar studies

While there are many studies on preterm birth and small-for-gestational-age birth, most either confound these two factors or look at a limited sample of women or infants. In the current study, the determinants of preterm and small-for-gestational-age birth were looked at separately at the population level (nearly 300,000 births). Before discussing the results, following is a brief summary of the findings of two studies similar in focus and scope.

In one study using a logistic regression analysis of more than 80,000 preterm and low birth weight infants born in Alberta between 1994 and 1996, key risk factors for preterm birth were stillbirth and multiple birth. Among modifiable factors, maternal prenatal smoking increased the odds of preterm birth, and women who smoked and consumed alcohol during pregnancy had further increased odds of preterm birth. Women who had three or fewer prenatal visits with a physician or midwife were more likely to have a preterm birth than women with four or more visits. Interestingly, maternal prenatal alcohol consumption, and maternal prenatal smoking among first time mothers were associated with decreased odds of preterm birth. [16]

Multiple births and stillbirths were the strongest predictors of low birth weight (as with preterm births). Modifiable predictors of low birth weight were maternal prenatal smoking, maternal street drug use, smoking combined with alcohol consumption, and having three or fewer prenatal visits with a physician or midwife. The odds of low birth weight were lower for first time mothers who smoked than non-first time mothers who didn't smoke. [16]

Thus in this study the predictors of low birth weight and preterm birth were quite similar. This may have been due to the heterogeneity of the low birth weight group: it did not discriminate between preterm and small-for-gestational-age births amongst the low birth weight population. The current report is an extension and update of this study, looking at a later and larger cohort of births (1997 to 2004), considering preterm and small-for-gestational-age births separately.

3.3 Similar studies
(continued)

A different study of 73,146 Alberta births occurring between 1994 and 1997 did consider these factors separately. This study showed that preterm and small-for-gestational-age were associated with different sets of predictors. [13]

Preterm delivery among Alberta women was found to be associated with maternal pre-existing medical conditions, past history of preterm birth, small-for-gestational-age birth, or neonatal death, and pregnancy complications. Modifiable factors associated with preterm birth included maternal age of 35 or more years, and maternal prenatal smoking and street drug use; these factors accounted for 11% of the overall preterm birth risk.[13]

Small-for-gestational-age births were more strongly associated with modifiable factors than preterm births, including low pre-pregnancy weight, advanced maternal age, and maternal prenatal smoking and street drug use. Nulliparity (giving birth for the first time), multiple gestation, and prior history of preterm birth or small-for-gestational-age birth were also predictive of inadequate fetal growth. The authors predicted that 24% of small-for-gestational-age births could be prevented if Alberta women stopped smoking during pregnancy. On average, infants born to women who smoked during pregnancy weighed 157 grams less than infants born to non-smoking mothers. [13]

The current study updates this work and extends it to a larger cohort of births, although the data in this report do not include pre-existing maternal medical conditions or pregnancy complications.

4 RESULTS

4.1 Overall findings

Table 4.1.1 lists the number of births included in each category of birth outcome, as well as the number of births in the model (the "total") for each analysis.

6.7% of all not-small-for-gestational-age live singleton births were preterm births (18,015 births). Of preterm live singleton births, 9.8% were small-for-gestational-age (1,949 births). Of term live singleton births, 8.0% were small-for-gestational-age (22,132). These three subgroups form the focus of the report.

The list of variables included in the models appears in Table 4.1.2, including the number and percent of live births in each category. See Section 2.2.3 for definitions of indicators.

The percentages in this table are based on the entire cohort of 304,161 live births to Alberta resident mothers between 1997 and 2004. Percentages do not add up to 100 in all cases due to missing data. Some indicators were quite rare and occurred in fewer than 5% of births (e.g., multiple birth, congenital anomaly, post-term gestation, birth weight under 1,500 grams, previous history of stillbirth, previous history of infant death, fewer than three prenatal visits, maternal prenatal alcohol consumption, and maternal prenatal street drug use). However, because of the large sample size, there were nevertheless thousands of births in these categories.

Table 4.1.3 lists birth weight and gestational age medians, means, and standard errors for each indicator.

For the 304,161 infants born live in Alberta between 1997 and 2004, the median birth weight was 3,410 grams and the mean was 3,378 grams (SE = 1.1 grams). The median gestational age was 39 weeks, with a mean of 38.9 weeks (SE = 0.0).

Because of the large sample size (and consequent small standard errors), virtually all categories differed significantly from one another, for both birth weight and gestational age indicators.

Factors associated with notable decrements in mean birth weight included female sex, diagnosis of congenital anomaly, preterm birth, previous stillbirth for the mother, previous infant death for the mother, cesarean section delivery, maternal prenatal smoking, and maternal prenatal street drug use. Post-term birth and attendance at prenatal classes (for first time moms) both had protective effects on birth weight.

4.1 Overall findings
(continued)

For gestational age, notable decrements in mean gestational age were associated with diagnosis of congenital anomaly, previous stillbirth for the mother, previous infant death for the mother, cesarean section delivery, and maternal prenatal street drug use. There were protective effects on gestational age of having three or more prenatal visits with a physician or midwife, and attending prenatal classes (for first time mothers).

Year of birth was included in all models. In the analyses of small-for-gestational-age preterm and term births, the odds ratios for year were significantly less than 1, reflecting the fact that the rate of small-for-gestational-age births declined in Alberta between 1997 and 2004. In the preterm not-small-for-gestational-age analysis, the effect of year was significantly greater than 1, reflecting the increasing preterm birth rate in Alberta between 1997 and 2004. Year of birth was included only to control for changes in indicators over time, and does not appear in the tables or figures for the models.

Table 4.1.1. Number and Percentage of Births by Birth Outcome Group, Alberta, 1997-2004

	Number	Total	% of total	Description of Total
Preterm births	25,099	304,161	8.3	All live births
Preterm births in not-SGA live singleton births	18,015	271,005	6.6	Not-small-for-gestational-age live singleton births
Preterm births in all live singleton births	19,964	295,086	6.8	All live singleton births
Small-for-gestational-age singleton births	24,081	295,086	8.2	All live singleton births
Small-for-gestational-age in preterm singleton births	1,949	19,964	9.8	Preterm live singleton births
Small-for-gestational-age in term singleton births	22,132	275,122	8.0	Term live singleton births

Source: Vital Statistics Birth, Stillbirth, and Death Files, Service Alberta, November 2006 release.

Notes: Data include Alberta residents only.

Data may differ from previously published data due to differences in definitions and dates of data extraction.

Table 4.1.2. Number and Percentage of Live Births by Infant and Maternal Indicators, All Live Births in Alberta (N=304,161), 1997 to 2004

Indicator	Category	Number	% of live births
Sex	**Male**	155,657	51.2
	Female	148,502	48.8
Rural residence	**Yes**	52,981	17.4
	No	241,513	79.4
Multiple birth	**Yes**	9,075	3.0
	No	295,086	97.0
Congenital Anomaly	**Yes**	10,235	3.4
	No	293,926	96.6
Term (weeks)	**Preterm (<37)**	25,099	8.3
	Term (37 to 42)	278,886	91.7
	Postterm (>42)	160	0.1
Small-for-gestational-age	Yes	24,778	8.1
	No	279,383	91.9
Maternal age (years)	<20	18,960	6.2
	20 - 34	241,614	79.4
	>34	43,569	14.3
Parity	**1**	126,446	41.6
	2	103,622	34.1
	>2	74,089	24.4
Marital status of parents	Married to each other	219,109	72.0
	Not married to each other	85,052	28.0
Number of previous aborted pregnancies	0	218,203	71.7
	1+	85,958	28.3
Number of previous stillbirths	0	301,224	99.0
	1+	2,937	1.0
Number of previous infant deaths	0	301,224	99.0
	1+	2,937	1.0
Onset of labour	Induced	70,922	23.3
	Spontaneous	173,287	57.0
Cesarean section delivery	Yes	55,312	18.2
	No	175,885	57.8
Number of prenatal visits in term births[1]	<3	4,665	1.7
	3+	213,119	76.4
Attendance at prenatal classes in first time mothers[2]	Yes	64,679	51.2
	No	38,064	30.1
Maternal prenatal smoking	Yes, or quit during pregnancy	66,339	21.8
	No	214,328	70.5
Maternal prenatal alcohol consumption	Yes	11,626	3.8
	No	265,452	87.3
Maternal prenatal street drug use	Yes	5,185	1.7
	No	267,785	88.0
Maternal smoking and drinking alcohol	Both	7,028	2.3
	Neither	233,224	76.7
Maternal smoking and drug use	Both	4,224	1.4
	Neither	236,861	77.9
Maternal smoking at age 35 or over	Both	6,127	2.0
	Neither	200,380	65.9
First time mom at age 35 or over	Both	10,829	3.6
	Neither	144,975	47.7
Maternal smoking and first time mother	Both	27,595	9.1
	Neither	138,971	45.7
Maternal smoking, drinking and drug use	Yes	1,836	0.6
	No	232,556	76.5

Source: Vital Statistics Birth, Stillbirth, and Death Files, Service Alberta, November 2006 release.

Notes: 1. Prenatal visits are shown for term births only; mothers who give birth before term have less chance to attend prenatal visits.

2. Attendance at prenatal classes is shown for first time mothers only, as attendance drops off considerably after the first birth.

Missing values are included in the calculation of percentages in the table.

Data include Alberta residents only.

Data may differ from previously published data due to differences in definitions and dates of data extraction.

Table 4.1.3. Mean, Median and Standard Error, Birth Weight and Gestational Age, By Infant and Maternal Indicators, All Live Births in Alberta (N=304,161), 1997 to 2004

Indicator	Category	Birth Weight			Gestational Age		
		Median	Mean	SE	Median	Mean	SE
Sex	**Male**	3,475	3,435	1.5	39	38.9	0.01
	Female	3,350	3,318	1.5	39	39.0	0.01
Rural residence	**Yes**	3,460	3,425	2.6	40	39.0	0.01
	No	3,400	3,366	1.2	39	38.9	0.00
Congenital Anomaly	**Yes**	3,230	3,072	8.5	39	37.7	0.04
	No	3,419	3,389	1.1	39	39.0	0.00
Term (weeks)	**Preterm (<37)**	2,430	2,343	4.6	35	33.8	0.02
	Term (37 to 42)	3,460	3,471	0.9	40	39.4	0.00
	Postterm (>42)	3,635	3,681	43.3	43	43.7	0.12
Small-for-gestational-age	**Yes**	2,700	2,580	2.9	39	38.7	0.02
	No	3,464	3,449	1.0	39	39.0	0.00
Maternal age (years)	**<20**	3,374	3,335	4.4	40	39.0	0.02
	20 - 34	3,420	3,387	1.2	39	39.0	0.00
	>34	3,390	3,347	3.0	39	38.7	0.01
Parity	**1**	3,365	3,334	1.6	40	39.0	0.01
	2	3,443	3,409	1.8	39	38.9	0.01
	>2	3,452	3,409	2.3	39	38.8	0.01
Marital status of parents	**Married to each other**	3,425	3,395	1.2	39	39.0	0.00
	Not married to each other	3,375	3,335	2.1	39	38.9	0.01
Number of previous aborted pregnancies	**0**	3,402	3,360	2.1	39	38.8	0.01
	1+	3,415	3,385	1.2	39	39.0	0.00
Number of previous stillbirths	**0**	3,339	3,246	9.4	39	38.2	0.04
	1+	3,413	3,381	1.1	39	39.0	0.00
Number of previous infant deaths	**0**	3,240	2,944	20.1	38	36.4	0.11
	1+	3,413	3,382	1.1	39	39.0	0.00
Onset of labour	**Induced**	3,472	3,439	2.2	40	39.3	0.01
	Spontaneous	3,400	3,371	1.4	39	38.9	0.01
Cesarean section delivery	**Yes**	3,370	3,295	3.1	39	38.4	0.01
	No	3,420	3,399	1.3	40	39.1	0.00
Number of prenatal visits in term births1	**<3**	3,460	3,467	1.9	39	39.1	0.00
	3+	3,460	3,472	1.0	39	38.6	0.01
Attendance at prenatal classes in first time mothers[2]	**Yes**	3,420	3,403	1.9	40	39.3	0.01
	No	3,319	3,265	2.5	39	38.8	0.01
Maternal prenatal smoking	**Yes, or quit during pregnancy**	3,300	3,264	2.3	39	38.8	0.01
	No	3,446	3,415	1.3	39	39.0	0.00
Maternal prenatal alcohol consumption	**Yes**	3,350	3,311	5.8	39	38.8	0.02
	No	3,415	3,383	1.1	39	39.0	0.00
Maternal prenatal street drug use	**Yes**	3,224	3,170	9.3	39	38.4	0.04
	No	3,415	3,384	1.1	39	39.0	0.00
Maternal smoking and drinking alcohol	**Both**	3,260	3,219	7.7	39	38.6	0.03
	Neither	3,440	3,409	1.2	39	39.0	0.00
Maternal smoking and drug use	**Both**	3,171	3,130	10.3	39	38.3	0.04
	Neither	3,443	3,410	1.2	39	39.0	0.00
Maternal smoking at age 35 or over	**Both**	3,211	3,160	8.1	39	38.5	0.03
	Neither	3,449	3,416	1.3	39	39.0	0.00
First time mom at age 35 or over	**Both**	3,288	3,240	6.1	39	38.7	0.02
	Neither	3,450	3,415	1.6	39	38.9	0.01
Maternal smoking and first time mother	**Both**	3,300	3,269	3.5	40	39.1	0.01
	Neither	3,488	3,450	1.6	39	38.9	0.01

Source: Vital Statistics Birth, Stillbirth, and Death Files, Service Alberta, November 2006 release.

Notes: 1. Prenatal visits are shown for term births only; mothers who give birth before term have less chance to attend prenatal visits.

2. Attendance at prenatal classes is shown for first time mothers only, as attendance drops off considerably after the first birth.

Missing values are included in the calculation of percentages in the table.

Data include Alberta residents only.

Data may differ from previously published data due to differences in definitions and dates of data extraction.

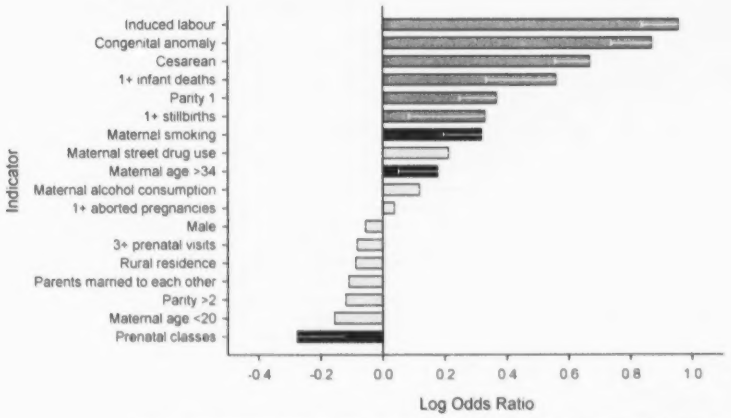
4.2 Small-for-Gestational-Age Preterm Births

Small-for-gestational-age preterm infants have the double disadvantage of being born before term and likely having suffered from growth restriction in utero. These infants have a high likelihood of infant morbidity or mortality.

The analysis of preterm SGA infants was limited to live born singletons, excluding stillborn infants and multiples in order to reduce confounding of factors affecting stillbirth and multiple births.

Between 1997 and 2004, Alberta resident mothers gave birth to 1,949 liveborn singletons who were both preterm and SGA. This is 9.8% of all preterm live singleton infants born during that period (see Table 4.1.1).

Figure 1. Predictors of SGA Preterm Births, Alberta, 1997 to 2004



Source: Vital Statistics Birth, Stillbirth, and Death Files, Service Alberta, November 2006 release

Logistic regression analysis of preterm live singleton births revealed that induced labour, congenital anomaly, cesarean section, and previous maternal history of infant death had the largest log odds ratios for SGA (see Table 4.2.1; explanation of figure conventions appears in Section 2.2.2).

Among potentially modifiable factors (bright red and green in the figure above), maternal prenatal smoking and maternal age of greater than 34 years were independently and significantly associated with preterm SGA singleton live births, after controlling for all other factors in the model. Attendance at prenatal classes had a protective effect after all other factors were controlled for.

Table 4.2.1. Rate, Adjusted Odds Ratios and Confidence Intervals, and Log Odds Ratios and Confidence Intervals for Small-for-Gestational-Age Births (n_{case}=1,949) in Preterm Singleton Live Births (N=19,964), by Infant and Maternal Indicators, Alberta, 1997 to 2004

Indicator	Category	Rate (%)	OR[1]	Lower 95% CI	Upper 95% CI	Log_e OR[2]	Lower 95% CI	Upper 95% CI
Sex	**Male**	9.6	0.95	0.86	1.04	-0.06	-0.15	0.04
	Female	9.9	1.00			0.00		
Rural residence	**Yes**	9.4	0.92	0.80	1.05	-0.09	-0.22	0.05
	No	9.9	1.00			0.00		
Congenital anomaly	**Yes**	21.2	2.38	2.09	2.72	0.87	0.74	1.00
	No	8.7	1.00			0.00		
Maternal age (years)	**<20**	9.5	0.86	0.70	1.05	-0.16	-0.36	0.05
	20 - 34	9.4	1.00			0.00		
	>34	11.7	1.19	1.05	1.36	0.18	0.05	0.30
Parity	**1**	10.9	1.44	1.28	1.63	0.37	0.24	0.49
	2	8.6	1.00			0.00		
	>2	9.0	0.89	0.77	1.03	-0.12	-0.26	0.02
Marital status of parents	**Married to each other**	9.3	0.90	0.80	1.01	-0.11	-0.23	0.01
	Not married to each other	10.7	1.00			0.00		
Number of previous aborted pregnancies	**1+**	10.6	1.04	0.93	1.15	0.04	-0.07	0.14
	0	9.4	1.00			0.00		
Number of previous stillbirths	**1+**	12.6	1.39	1.09	1.78	0.33	0.08	0.58
	0	9.7	1.00			0.00		
Number of previous infant deaths	**1+**	17.2	1.75	1.39	2.20	0.56	0.33	0.79
	0	9.5	1.00			0.00		
Number of prenatal visits	**3+**	9.7	0.92	0.72	1.18	-0.08	-0.33	0.17
	<3	9.8	1.00			0.00		
Attendance at prenatal classes	**Yes**	8.3	0.76	0.66	0.88	-0.28	-0.42	-0.13
	No	10.1	1.00			0.00		
Onset of labour	**Induced**	14.5	2.60	2.30	2.94	0.96	0.83	1.08
	Spontaneous	6.0	1.00			0.00		
Cesarean section	**Yes**	16.0	1.95	1.74	2.19	0.67	0.55	0.78
	No	7.5	1.00			0.00		
Maternal prenatal smoking	**Yes, or quit during pregnancy**	11.6	1.38	1.22	1.56	0.32	0.20	0.44
	No	9.1	1.00			0.00		
Maternal prenatal alcohol consumption	**Yes**	11.9	1.13	0.90	1.41	0.12	-0.10	0.34
	No	9.7	1.00			0.00		
Maternal prenatal street drug use	**Yes**	12.6	1.24	0.95	1.61	0.21	-0.05	0.48
	No	9.7	1.00			0.00		
Maternal smoking and alcohol consumption	**Both**	12.8	Non-significant (excluded)			Non-significant (excluded)		
	Neither	9.1						
Maternal smoking and drug use	**Both**	12.3	Non-significant (excluded)			Non-significant (excluded)		
	Neither	9.0						
Maternal smoking and first time mother	**Both**	13.2	Non-significant (excluded)			Non-significant (excluded)		
	Neither	8.0						
Maternal smoking at age 35 or over	**Both**	15.6	Non-significant (excluded)			Non-significant (excluded)		
	Neither	8.7						
First time mother at age 35 or over	**Both**	15.6	Non-significant (excluded)			Non-significant (excluded)		
	Neither	8.5						

Source: Vital Statistics Birth, Stillbirth and Death Files, Service Alberta, November 2006 release

Notes 1 Adjusted odds ratio (OR). OR is significant when the confidence interval does not include 1

2 Log odds ratio (Log_e OR). Log_e OR is significant when the confidence interval does not include 0

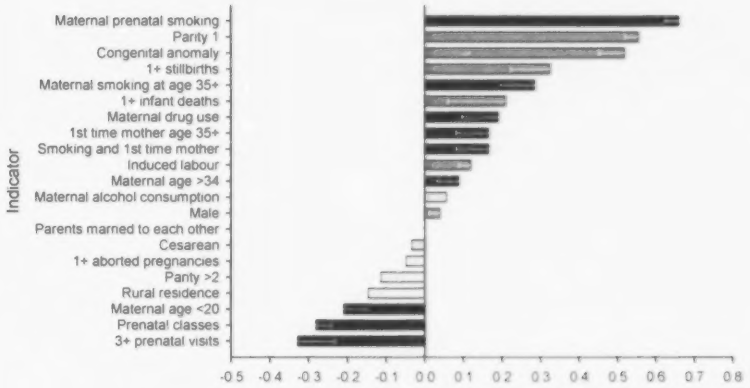
Data include Alberta residents only

Data may differ from previously published data due to differences in definitions and dates of data extraction

4.3 Small-for-Gestational-Age Term Births

The predictors of SGA liveborn infants who were born at term were looked at next. These are the infants who were likely growth restricted in utero, but who did not have the additional disadvantage of being born preterm. There were 22,132 term SGA liveborn singletons born to Alberta resident mothers between 1997 and 2004, which is 8.0% of all term live singleton births during that time period (see Table 4.1.1).

Figure 2. Predictors of SGA Term Births, Alberta, 1997 to 2004



Source: Vital Statistics Birth, Stillbirth, and Death Files, Service Alberta, November 2006 release

All indicators were entered into a logistic regression model. The predictor with the largest log odds ratio was maternal prenatal smoking, followed by first time mother (parity = 1), and diagnosis of congenital anomaly (see Table 4.3.1; explanation of figure conventions appears in Section 2.2.2).

There were significant independent effects of maternal prenatal smoking in women giving birth at age 35 or older, maternal prenatal street drug use, maternal prenatal smoking in first time mothers, and maternal age of 35 or older. Furthermore, there were protective effects of three or more prenatal visits with a physician or midwife, attendance at prenatal classes (for first time moms), and maternal age under 20 years.

Clearly, the incidence of term SGA singleton live birth in Alberta is influenced strongly by modifiable risk factors.

4.3 Small-for-Gestational-Age Term Births
(continued)

When the models for SGA in term and preterm live singleton births are contrasted, a few obvious differences emerge. Induced labour, congenital anomalies, and previous maternal history of infant death are all more strongly associated with SGA in preterm births than with SGA in term births. On the other hand, maternal prenatal smoking, parity of one, and interactions including these factors are all more strongly associated with SGA in term births than with SGA in preterm births. The protective effect of three or more prenatal visits is stronger for SGA in term births than for SGA in preterm births (this is at least partially due to the reduced opportunity for prenatal visits in births that occur before term).

In summary, there is much hope for modifying the incidence of SGA at term in singleton live births. Suggested strategies include educating women about the risks involved in engaging in undesirable behaviours such as prenatal smoking or street drug use, and in delayed childbearing. Attendance at prenatal classes and regular visits with a physician or midwife are obviously associated with reduced risk of SGA. Pregnant women and their caregivers could benefit as well from awareness of increased risk of SGA birth in first time mothers.

Table 4.3.1. Rate, Adjusted Odds Ratios and Confidence Intervals, and Log Odds Ratios and Confidence Intervals for Small-for-Gestational-Age Births (n_{case}=22,132) in Term Singleton Live Births (N=275,122), by Infant and Maternal Indicators, Alberta, 1997 to 2004

Indicator	Category	Rate (%)	OR[1]	Lower 95% CI	Upper 95% CI	Log_e OR[2]	Lower 95% CI	Upper 95% CI
Sex	**Male**	8.2	1.04	1.01	1.07	0.04	0.01	0.07
	Female	7.9	1.00			0.00		
Rural residence	**Yes**	7.3	0.86	0.83	0.90	-0.15	-0.19	-0.11
	No	8.2	1.00			0.00		
Congenital anomaly	**Yes**	12.8	1.68	1.57	1.80	0.52	0.45	0.59
	No	7.9	1.00			0.00		
Maternal age (years)	**<20**	9.9	0.81	0.77	0.86	-0.21	-0.27	-0.15
	20 - 34	7.9	1.00			0.00		
	>34	8.3	1.09	1.03	1.16	0.09	0.03	0.14
Parity	**1**	10.1	1.74	1.68	1.81	0.56	0.52	0.59
	2	6.7	1.00			0.00		
	>2	6.5	0.89	0.86	0.93	-0.11	-0.16	-0.07
Marital status of parents	**Married to each other**	7.4	1.00	0.97	1.04	0.00	-0.03	0.04
	Not married to each other	9.8	1.00			0.00		
Number of previous aborted pregnancies	**1+**	8.0	0.95	0.92	0.98	-0.05	-0.08	-0.02
	0	8.1	1.00			0.00		
Number of previous stillbirths	**1+**	8.6	1.38	1.25	1.54	0.32	0.22	0.43
	0	8.0	1.00			0.00		
Number of previous infant deaths	**1+**	9.0	1.23	1.06	1.43	0.21	0.06	0.36
	0	8.0	1.00			0.00		
Number of prenatal visits	**3+**	8.0	0.72	0.66	0.79	-0.33	-0.42	-0.23
	<3	8.3	1.00			0.00		
Attendance at prenatal classes	**Yes**	8.0	0.76	0.73	0.78	-0.28	-0.32	-0.24
	No	8.1	1.00			0.00		
Onset of labour	**Induced**	8.9	1.13	1.09	1.17	0.12	0.09	0.15
	Spontaneous	7.8	1.00			0.00		
Cesarean section	**Yes**	8.3	0.97	0.93	1.01	-0.03	-0.08	0.01
	No	8.2				0.00		
Maternal prenatal smoking	**Yes, or quit during pregnancy**	12.5	1.94	1.87	2.01	0.66	0.62	0.70
	No	6.7	1.00			0.00		
Maternal prenatal alcohol consumption	**Yes**	11.1	1.06	0.99	1.13	0.06	-0.01	0.12
	No	7.9	1.00			0.00		
Maternal prenatal street drug use	**Yes**	13.7	1.21	1.10	1.33	0.19	0.10	0.29
	No	7.9				0.00		
Maternal smoking and alcohol consumption	**Both**	14.1	Non-significant (excluded)			Non-significant (excluded)		
	Neither	6.8						
Maternal smoking and drug use	**Both**	15.3	Non-significant (excluded)			Non-significant (excluded)		
	Neither	6.8						
Maternal smoking and first time mother	**Both**	13.8	1.18	1.09	1.28	0.16	0.08	0.25
	Neither	5.2	1.00			0.00		
Maternal smoking at age 35 or over	**Both**	16.2	1.33	1.22	1.46	0.29	0.20	0.38
	Neither	6.8	1.00			0.00		
First time mother at age 35 or over	**Both**	12.3	1.18	1.09	1.28	0.16	0.08	0.25
	Neither	6.5	1.00			0.00		

Source: Vital Statistics Birth, Stillbirth, and Death Files, Service Alberta, November 2006 release

Notes 1. Adjusted odds ratio (OR). OR is significant when the confidence interval does not include 1

2. Log odds ratio (Log_e OR). Log_e OR is significant when the confidence interval does not include 0

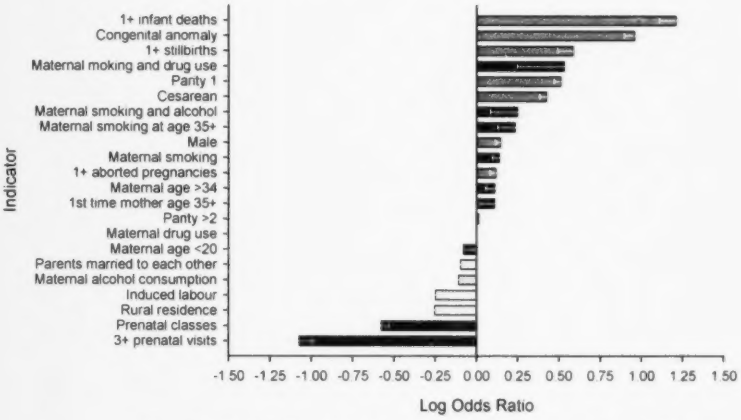
Data include Alberta residents only

Data may differ from previously published data due to differences in definitions and dates of data extraction

4.4 Not-Small-for-Gestational-Age Preterm Births

The third analysis looked at factors predicting preterm birth, in the absence of confounding factors such as SGA, multiple birth, or stillbirth. The focus was thus on factors associated with preterm liveborn singletons who were not SGA, and therefore likely not suffering from IUGR. There were 18,015 preterm not-SGA live singleton births between 1997 and 2004, out of 271,005 total not-SGA live singleton births (6.7% preterm).

Figure 3. Predictors of Not-SGA Preterm Births, Alberta, 1997 to 2004



Source: Vital Statistics Birth, Stillbirth, and Death Files, Service Alberta, November 2006 release

Logistic regression analysis with all factors entered showed the largest odds ratios of increased risk of preterm in not-SGA births for previous maternal history of infant death, congenital anomaly, and three or more prenatal visits (see Table 4.4.1; explanation of figure conventions appears in Section 2.2.2).

Among potentially modifiable factors, there was significantly increased risk for interactions involving maternal smoking (maternal smoking and maternal street drug use, maternal smoking and maternal alcohol consumption, and smoking among mothers who were 35 or older at the time of the birth), maternal smoking alone, maternal age 35 or older, and first time mother at the age of 35 or older. There were also significant independent protective effects of potentially modifiable factors, including strong effects of three or more prenatal visits and attendance at prenatal classes, and a small protective effect of maternal age under 20 years.

4.4 Not-Small-for-Gestational-Age Preterm Births (continued)

Thus, while prenatal smoking and prenatal care play significant roles in rates of preterm in not-SGA births, there is a strong role for previous obstetric history and presence of congenital anomaly.

Table 4.4.1. Rate, Adjusted Odds Ratios and Confidence Intervals, and Log Odds Ratios and Confidence Intervals for Preterm Births (n_{case}=18,015) in Not-Small-for-Gestational-Age Singleton Live Births (N=271,005), by Infant and Maternal Indicators, Alberta, 1997 to 2004

Indicator	Category	Rate (%)	OR[1]	Lower 95% CI	Upper 95% CI	Log_e OR[2]	Lower 95% CI	Upper 95% CI
Sex	**Male**	7.2	1.16	1.12	1.19	0.14	0.11	0.18
	Female	6.1				0.00		
Rural residence	**Yes**	6.2	0.78	0.74	0.81	-0.25	-0.30	-0.21
	No	6.8	1.00			0.00		
Congenital anomaly	**Yes**	16.1	2.61	2.45	2.78	0.96	0.90	1.02
	No	6.3	1.00			0.00		
Maternal age (years)	**<20**	8.0	0.92	0.87	0.99	-0.08	-0.14	-0.01
	20 - 34	6.4	1.00			0.00		
	>34	7.5	1.12	1.06	1.18	0.11	0.05	0.17
Parity	**1**	7.4	1.67	1.60	1.74	0.51	0.47	0.55
	2	5.7	1.00			0.00		
	>2	6.7	1.01	0.97	1.06	0.01	-0.03	0.06
Marital status of parents	**Married to each other**	6.1	0.91	0.87	0.95	-0.10	-0.13	-0.06
	Not married to each other	8.1	1.00			0.00		
Number of previous aborted pregnancies	**1+**	7.4	1.13	1.09	1.17	0.12	0.08	0.15
	0	6.3	1.00			0.00		
Number of previous stillbirths	**1+**	11.9	1.79	1.64	1.97	0.58	0.49	0.68
	0	6.5	1.00			0.00		
Number of previous infant deaths	**1+**	21.6	3.36	3.03	3.72	1.21	1.11	1.31
	0	6.5	1.00			0.00		
Number of prenatal visits	**3+**	5.3	0.34	0.32	0.37	-1.07	-1.16	-0.99
	<3	10.8	1.00			0.00		
Attendance at prenatal classes	**Yes**	5.1	0.56	0.54	0.59	-0.58	-0.62	-0.53
	No	7.2	1.00			0.00		
Onset of labour	**Induced**	5.4	0.78	0.75	0.81	-0.25	-0.29	-0.21
	Spontaneous	6.7	1.00			0.00		
Cesarean section	**Yes**	9.7	1.53	1.47	1.60	0.43	0.38	0.47
	No	5.9	1.00			0.00		
Maternal prenatal smoking	**Yes, or quit during pregnancy**	8.4	1.15	1.10	1.20	0.14	0.09	0.18
	No	6.0	1.00			0.00		
Maternal prenatal alcohol consumption	**Yes**	9.1	0.90	0.79	1.03	-0.11	-0.24	0.03
	No	6.4	1.00			0.00		
Maternal prenatal street drug use	**Yes**	13.9	1.00	0.77	1.31	0.00	-0.26	0.27
	No	6.4	1.00			0.00		
Maternal smoking and alcohol consumption	**Both**	11.5	1.28	1.09	1.51	0.25	0.08	0.41
	Neither	6.2	1.00			0.00		
Maternal smoking and drug use	**Both**	15.4	1.70	1.28	2.26	0.53	0.25	0.82
	Neither	6.2	1.00			0.00		
Maternal smoking and first time mother	**Both**	7.9	Non-significant (excluded)			Non-significant (excluded)		
	Neither	5.4						
Maternal smoking at age 35 or over	**Both**	11.2	1.26	1.14	1.41	0.23	0.13	0.34
	Neither	6.0	1.00			0.00		
First time mother at age 35 or over	**Both**	9.1	1.12	1.02	1.23	0.11	0.02	0.20
	Neither	5.9	1.00			0.00		

Source: Vital Statistics Birth, Stillbirth, and Death Files, Service Alberta, November 2006 release

Notes 1. Adjusted odds ratio (OR). OR is significant when the confidence interval does not include 1

2. Log odds ratio (Log_e OR). Log_e OR is significant when the confidence interval does not include 0

Data include Alberta residents only

Data may differ from previously published data due to differences in definitions and dates of data extraction

4.5 Summary

Preterm SGA births are strongly predicted by congenital anomaly, previous infant deaths and stillbirths, induced labour and cesarean section. Clearly, these births occur to mothers with a previous history of adverse outcomes, with births that have adverse outcomes themselves (congenital anomalies), and in births that require labour induction or cesarean sections. Many of these factors are not directly modifiable. However, there were still significant (though smaller) independent effects of maternal prenatal smoking and advanced maternal age, with protection from prenatal class attendance. At least some of the cases of the most disadvantaged gestations (preterm, with likely IUGR) could be ameliorated with cessation of prenatal smoking, reduction in late childbearing, and good prenatal education.

SGA births at term account for 92% of all SGA births (multiple births excluded). In contrast to SGA births that are preterm, SGA births at term have strong associations with modifiable factors. The largest odds ratio for SGA births at term was for maternal smoking. Mothers 35 and older were also at increased risk of SGA in term births, especially smoking mothers or first time mothers. Prenatal care (visits and prenatal classes) had a protective effect, as did birth before the age of 20. There appears to be clear room for improvement in the rate of 8.0% SGA among term births, if mothers can be encouraged to stop smoking, to avoid childbirth at advanced maternal age, and to seek good prenatal care.

Although preterm not-SGA births are solidly associated with previous adverse events and congenital anomalies, prenatal care is strongly associated with reduced risk. Smoking and advanced maternal age also have roles in these births.

Consistent with previous literature, SGA births in Alberta women appear to be more closely associated with modifiable factors than preterm births, though there are significant effects of modifiable factors in all three groups of birth outcomes.

4.5 Summary (continued)

The current results were distinct from the earlier study of Alberta birth registrations from 1994 to 1997 discussed in the Introduction [16]. In that study, preterm and low birth weight births were studied, without separation of preterm and SGA factors, and without exclusion of multiple births. The current results are in accord with this study, in that strong roles for maternal smoking and substance use, advanced maternal age, and prenatal care were found. The earlier study found very similar predictors for preterm and low birth weight births, however. With the methodology used in this study, it was demonstrated that preterm and SGA differ in their associations with modifiable factors, in particular that SGA births were more likely amenable to modification with changes in maternal behaviours.

The current findings were largely consistent with a previous study that looked at preterm and SGA births occurring in Alberta between 1994 and 1997. [13] Preterm deliveries in that study were associated with previous history of adverse events, advanced maternal age, and maternal smoking and street drug use, as in the present findings. There were also significant roles for pre-existing medical conditions and complications of pregnancy in the earlier study; data on these indicators were lacking in this study. SGA deliveries were more strongly associated with modifiable factors in the earlier study as in the present study, including low pre-pregnancy weight, advanced maternal age, and maternal prenatal smoking and street drug use. The results in this report confirm the pattern of findings with updated data (1997 to 2004), in the context of high and increasing rates of preterm birth and high rates of small-for-gestational-age birth during recent years.

It would be valuable to attempt linkage of additional data sources (such as maternal pre-existing conditions and pregnancy complications) to the current database, in order to extend findings to these important factors. Linkage to infant outcomes in later life would be interesting as well.

Alberta women, their caregivers, and various levels of government all have roles in reducing the risk of preterm and SGA births (and associated adverse outcomes). Available and accessible counseling about risks and provision of cessation programs for maternal prenatal substance use may help reduced rates of preterm and SGA births. Regular high-quality prenatal care that is universally available and enhanced career and social support for women leaving the workforce to raise children may also reduce adverse outcomes.

5 REFERENCES

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